REMARKS

The following remarks are made in response to the Non-Final Office Action mailed May 3, 2006. Claims 18-29 have been withdrawn from consideration. Claims 10-17 were rejected. With this Response, no claims have been amended. Claims 10-17 remain pending in the application and are presented for reconsideration and allowance.

Claim Rejections under 35 U.S.C. § 102

The Examiner rejected claims 10-17 under 35 U.S.C. § 102(b) as being anticipated by or, in the alternative, under 35 U.S.C. § 103(a) as obvious over the Anthony et al. U.S. Patent No. 6,172,904. Applicant respectfully submits, however, that the Anthony reference does not teach or suggest the features the claims.

Claim 10 recites a method for fabricating a reference layer for MRAM memory cells. The method includes providing a layer system for the reference layer. The layer system has a first layer of a material having a first Curie temperature. The first layer has a saturation field strength and can be permanently magnetized by an external magnetic field. The layer system has a second layer of a material having a second Curie temperature, which is significantly lower than the first Curie temperature. ***The second layer can be magnetized by antiferromagnetic coupling with the first layer.*** The method includes generating an external magnetic field having a field strength and cooling the layer system from a temperature above the first Curie temperature to below the first Curie temperature by action of the external magnetic field. The field strength of the external magnetic field is greater than the saturation field strength of the first layer, so that magnetization of the first layer is oriented by a second-order phase transition along the field direction of the external magnetic field. The layer system is then subsequently cooled below the second Curie temperature and magnetization of the second layer is oriented antiparallel with respect to the magnetization of the first layer ***on account of antiferromagnetic coupling between the first and second layers.***

The Anthony reference does not teach or suggest antiferromagnetic coupling between any first and second reference layers. In the Anthony reference, the layers 66 and 68, which are used for magnetizing the two reference layers 54 and 55, are genuine antiferromagnetic layers each

having the different "blocking" temperatures (corresponding to the Curie temperature). During the magnetizing process, the magnetic orientation of the first (upper) reference layer 54 is pinned by the antiferromagnetic layer 66 which is on top of the first (upper) reference layer 54, while the magnetic orientation of the second lower reference layer 50 is pinned by the antiferrogmagnetic layer 68 which is beneath the second (lower) reference layer 50.

The magnetizing process is carried out under the action of an external magnetic field, and caused by the different blocking temperatures (Curie temperatures) of the upper and lower genuine antiferromagnetic layers 66 and 68. At first, the magnetic orientation of the first (upper) reference layer 54 is pinned by lowering the temperature below the first (upper) blocking temperature. As such, the direction of the external magnetic field is reversed (M3-M1) and then the temperature is lowered below the second blocking temperature. Thereby, the magnetic orientation of the second (lower) reference layer 50 is pinned by the lower genuine antiferromagnetic layer 68.

During this process, the magnetic orientation of both reference layers 54 and 50 (separated by the intermediate "sense layer" 52) are driven into a first and a second (reverse) direction by means of the adjacent antiferrogmagetic layers 66 and 68, respectively (cf. Fig. 1 of the Anthony reference). The reference layers 54 and 50 are not, however, antiferromagnetically coupled to each other.

In contradiction, in the present method for fabricating a reference layer for MRAM memory cells both layers 10 and 11 of the system of reference layers R and R´, respectively, which are stacked directly or separated by a very thin intermediate coupling layer become after the magnetization process an artificial antiferromagnet AAF. Here it should be emphasized that both layers 10 and 11 of the reference layer system R and R´, respectively, are not genuine antiferrogmagnetic layers as it is described in the Anthony reference. Therefore, the MRAM memory cell fabricated by means of the present method can be realized more simply and with lower costs as the memory cell according to the Anthony reference, which necessitates the genuine antiferromagnetic material layers 66 and 68 for magnetizing both reference layers 54 and 50.

Furthermore, the remaining art of record neither discloses nor suggests the present method for fabricating a reference layer of a MRAM memory cell.

Therefore, Applicants respectfully request reconsideration and withdrawal of the 35 U.S.C. § 102(b) rejection to claims 10-17, and request allowance of these claims.

CONCLUSION

In view of the above, Applicant respectfully submits that pending claims 10-17 are in form for allowance and are not taught or suggested by the cited references. Therefore, reconsideration and withdrawal of the rejections and allowance of claims 10-17 are respectfully requested.

No fees are required under 37 C.F.R. 1.16(b)(c). However, if such fees are required, the Patent Office is hereby authorized to charge Deposit Account No. 50-0471.

The Examiner is invited to contact the Applicant's representative at the below-listed telephone numbers to facilitate prosecution of this application.

Response
Applicant: Manfred Ruehrig et al.
Serial No.: 10/509,553
Filed: May 17, 2005
Docket No.: I433.125.101/13.305
Title: MRAM MEMORY CELL WITH A REFERENCE LAYER AND METHOD FOR FABRICATING

Any inquiry regarding this Response should be directed to Paul P. Kempf at Telephone No. (612) 767-2502, Facsimile No. (612) 573-2005. In addition, all correspondence should continue to be directed to the following address:

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Respectfully submitted,

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CERTIFICATE UNDER 37 C.F.R. 1.8:

The undersigned hereby certifies that this paper or papers, as described herein, are being transmitted via facsimile to Facsimile No. (571) 273-8300 on this 3rd day of August, 2006.

By: _____
Name: Paul P. Kempf